IMPORTANCE OF HEADWATER STREAMS AND WETLANDS

The health of our nation's waterways – our rivers, lakes, bays and coastal waters – depends on the headwater streams and wetlands where they begin.

The ultimate sources of a river often appear insignificant. They could be a drizzle of snowmelt that runs down a mountainside crease, a small spring-fed pond, or a depression in the ground that fills with water after every rain and overflows into the creek below. Such water sources, which scientists refer to as headwater streams and wetlands, are often unnamed and rarely appear on maps. Yet the health of these small streams and wetlands is critical to the health of the entire river network and downstream communities.

Headwater streams and wetlands trap floodwaters, recharge groundwater supplies, remove pollution, provide fish and wildlife habitat, and sustain the health of downstream rivers, lakes, and bays. Because small streams and wetlands are the source of the nation's fresh waters, changes that harm these headwaters affect streams, lakes and rivers downstream.

Headwaters can be intermittent streams that flow briefly when snow melts or after rain, but shrink in dry times to become individual pools filled with water. Desert headwater streams can arise from a spring and run above ground only a few hundred yards before disappearing into the sand. Other spring-fed headwaters contain clear water with steady temperature and flow. Yet other headwaters originate in marshy meadows filled with sluggish tea-colored water. A headwater may be perennial, intermittent or ephemeral.

Perennial streams typically have water flowing in them year-round. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow and runoff from rainfall or other precipitation is supplemental.

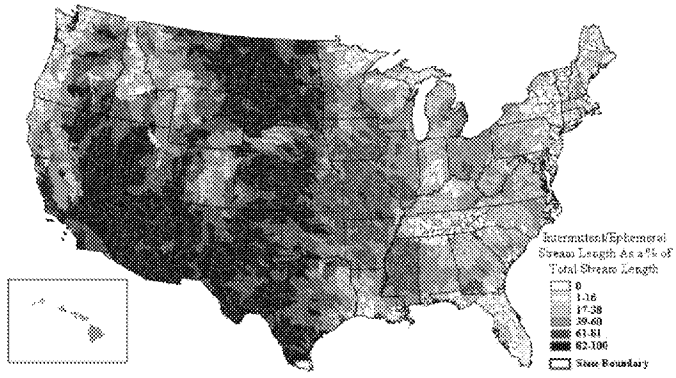
Intermittent streams flow during certain times of the year, when groundwater provides enough water for stream flow. Runoff from rainfall or other precipitation supplements the flow of intermittent stream. During dry periods, intermittent streams may not have flowing water.

Ephemeral streams flow only during, and for a short time after, rainfall or other precipitation. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for ephemeral streams. Runoff from rainfall is the primary source of water for ephemeral streams.

Wetlands generally include swamps, marshes, bogs and similar areas. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance. Indeed, wetlands are found from the tundra to the tropics and on every continent except Antarctica.

A wetland that is completely surrounded by land is considered isolated. While many isolated wetlands have no apparent connection to surface water like rivers, lakes or the ocean, they are rarely hydrologically isolated because most wetlands have important groundwater connections.

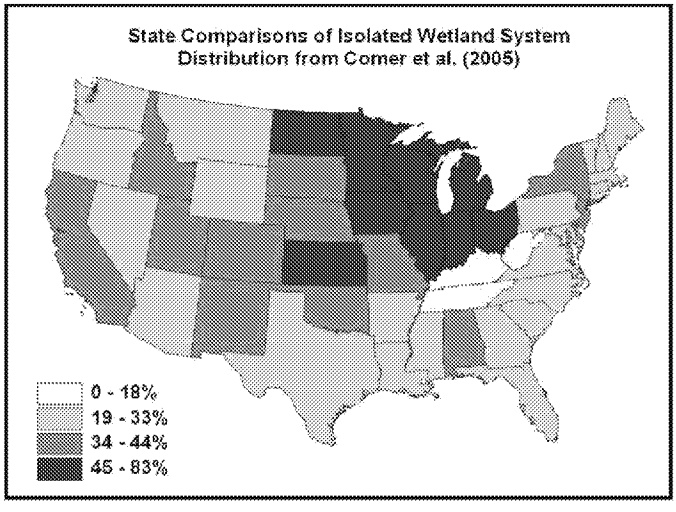
For example, during a four-year study period nearly 20% of the precipitation that fell on wetlands in the Texas coastal plain flowed as surface runoff through an intermittent stream to a nearby waterway, the Armand Bayou.



Headwater streams are the smallest parts of river and stream networks, but make up the majority of river miles in the United States. Almost 60 percent of stream miles in the continental U.S can be considered headwaters that flow seasonally or after storms. The very foundation of our nation's great rivers is a vast network of unknown, unnamed and underappreciated headwater streams.

The highest proportion of intermittent and ephemeral streams is found in the arid Southwest and Midwest portions of the country. For example, more than 95% of the streams in Arizona are intermittent.

Headwater streams are the source of approximately 60% of the flow to all northeastern U.S. streams and rivers.



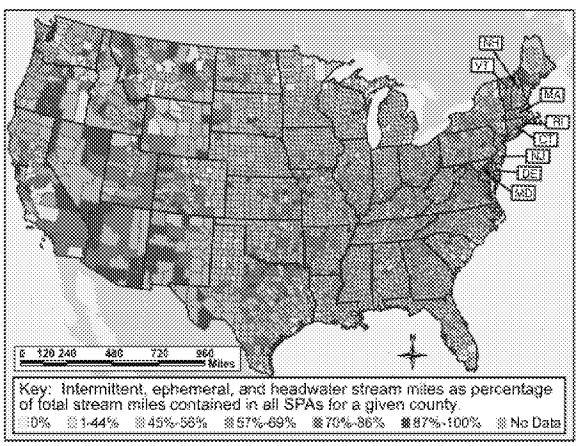
Approximately 20% to 30% of the wetland acreage in the continental U.S. (equivalent to 20 million acres) could be considered isolated.

Isolated Wetland Type State or Region Found
Prairie potholes: Upper Midwest
Playas: Southwest
Rainwater basin wetlands: South-central Nebraska
Sandhills wetlands: North-central Nebraska
Salt flats and salt lake wetlands: Great Basin
Channeled scablands wetlands: Eastern Washington
Desert spring wetlands: Arid West and Southwest
Kettle hole wetlands: Glaciated regions
Delmarva pothole wetlands: Delmarva Peninsula
Coastal plain ponds: Atlantic-Gulf coastal plain
Gum ponds: Southeast
Carolina Bay wetlands and Pocosin wetlands: South Atlantic coastal plain
Cypress domes: Florida
Sinkhole wetlands: Karst regions
West Coast vernal pools: West coast
Woodland vernal pools: Forested regions
Interdunal and intradunal wetlands: Coastal areas
Alvar wetlands: Great Lakes shoreline

The highest proportions of isolated wetlands are found in the upper Great Lakes, north-central interior and Great Plains regions

CLEAN DRINKING WATER

These headwater streams and wetlands play a critical role in the quality and supply of our drinking water by ensuring a continuous flow of clean water to surface waters and helping recharge underground aquifers. In the continental United States, 357,404 total miles of streams provide water for public drinking water systems that use surface water. Of that total, 58% (207,476 miles) are headwater streams. **Approximately 117 million people – over one-third of the total U.S. population – get some or all of their drinking water from public drinking water systems that rely in part on these streams.**



GROUNDWATER RECHARGE

Headwater streams are vital for recharging the nation's groundwater supply. During high flows, water enters the groundwater through the stream bed, reducing the volume that travels downstream. During dry periods, groundwater replenishes flow in the stream to feed downstream waterways. Even in arid regions, water infiltrated from headwater streams supports springs, streamflow, isolated wetlands, or plants far from the recharge areas.

Most isolated wetlands do not have an obvious surface water connection, but they store and slowly release water into groundwater, aquifers and surface waters. The storage capacity of isolated wetlands can be enormous. For example, South Carolina's isolated wetlands are estimated to store 4.58 billion gallons of water. The cost to construct stormwater management facilities to detain this volume of water is estimated at more than $200 million.

In the southwestern U.S., shallow groundwater storage with gradual release into stream channels by intermittent and ephemeral streams, is a major source of flow in rivers.

FLOOD AND EROSION PROTECTION

Headwater streams and wetlands absorb significant amounts of rainwater, runoff and snowmelt before flooding.

Headwater streams play a critical role in downstream waters by moderating flooding during periods of high flow and by maintaining flow during dry weather. These functions are possibly due to the significant storage and recharge capacity of these systems.

Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Trees, root mats, and other wetland vegetation also slow the speed of flood waters and distribute them more slowly over the floodplain. This lowers flood heights and reduces erosion.

For example, peak discharges between upstream and downstream gauging stations on the Cache River in Arkansas were reduced 10–20% primarily due to floodplain water storage.

Hydrologic models of prairie potholes in the Starkweather Coulee subbasin (North Dakota) that drains to Devils Lake indicate that increasing the volume of pothole storage across the sub-basin by approximately 60% caused simulated total annual streamflow to decrease 50% during a series of dry years and 20% during wet years. Similar simulation studies of watersheds that feed the Red River of the North in North Dakota and Minnesota demonstrated similar results, suggesting that the ability of potholes to modulate streamflow may be widespread across portions of the prairie pothole region.

Wetlands near urban areas are particularly valuable, counteracting the rate and volume of water runoff from pavement and buildings. The holding capacity of wetlands helps control floods and prevents water logging of crops. Preserving and restoring wetlands can often help provide the level of flood control otherwise provided by expensive dredge operations and levees. The wetlands along the Mississippi River once stored at least 60 days of floodwater. Now they store only 12 days because most have been filled or drained.

The ability of wetlands to control erosion is so valuable that some states are restoring wetlands in coastal areas to buffer the storm surges from hurricanes and tropical storms. Wetlands at the margins of lakes, rivers, bays, and the ocean protect shorelines and stream banks against erosion. Wetland plants hold the soil in place with their roots, absorb the energy of waves, and break up the flow of stream or river currents.

REDUCE POLLUTION

The water quality of downstream waters is strongly influenced by the quality of water coming from the headwater streams and wetlands that feed into them. These headwater systems retain and process excess nutrients, such as nitrogen and phosphorus, and prevent them from traveling further downstream. Headwater streams actually process more than 50 percent of the nitrogen from their watersheds.

Another water quality benefit of headwater streams and isolated wetlands is that they trap and retain much of the sediment that washes into them, preventing excess sediment downstream. Once sediment moves downstream, it becomes an expensive problem. Too much sediment can fill up reservoirs and navigation channels, damage commercial and sport fisheries, eliminate recreation spots, harm aquatic habitats and their associated plants and animals, and increase water filtration costs. For example, keeping Baltimore Harbor navigable costs $10 to $11.5 million annually to dredge and dispose of sediment the Patapsco River deposits in the harbor.

Headwater streams can store sediment for long periods of time: research in Oregon's Rock Creek basin found that headwater streams could retain sediment for 114 years.

Wetlands are excellent at filtering pollution. As the runoff water passes through, the wetlands retain excess nutrients and some pollutants, and reduce sediment that would clog waterways. Because of this filtering ability, wetlands prevent expensive treatment downstream. For example, a 1990 study showed that, without the Congaree Bottomland Hardwood Swamp in South Carolina, the area would need a $5 million wastewater treatment plant.

In one study, sewage wastewaters were applied to forested wetlands in Florida for four years. More than 95% of the phosphorus, nitrate, ammonium, and total nitrogen were removed by the wetland during the study period. In another study, sizeable phosphorus retention occurred in marshes that comprised only 7% of the lower Lake Okeechobee basin area in Florida. A bog in Massachusetts trapped nearly 80% of nitrogen inputs and prairie pothole wetlands in the upper Midwest removed over 80% of the nitrate load. A large prairie marsh removed 86% of nitrate, 78% of ammonium, and 20% of phosphate.

WILDLIFE HABITAT

Headwater streams are unique and diverse habitats that can support hundreds to thousands of species, including plants, fish, amphibians, birds, and mammals. Headwater streams range from icy-cold brooks tumbling down steep, boulder-filled channels to outflows from desert springs that trickle along a wash for a short distance before disappearing into the sand. These streams are important as spawning and nursery habitats, seasonal feeding areas, refuge from predators and competitors, shelter from extreme weather, and travel corridors.

Many headwater species, including fish, snails, crayfish, insects and salamanders, are now in danger of extinction as a result of human actions. A few dozen headwater species are already listed under the U.S. Endangered Species Act; hundreds of others are rare enough to be considered for listing.

More than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half use wetlands at some point in their lives. Many other animals and plants depend on wetlands for survival. Estuarine and marine fish and shellfish, various birds, and certain mammals must have coastal wetlands to survive. Most commercial and game fish breed and raise their young in coastal marshes and estuaries. Menhaden, flounder, sea trout, spot, croaker, and striped bass are among the more familiar fish that depend on coastal wetlands. Shrimp, oysters, clams, and blue and Dungeness crabs likewise need these wetlands for food, shelter, and breeding grounds. For many animals and plants, like wood ducks, muskrat, cattails, and swamp rose, inland wetlands are the only places they can live. For others, such as striped bass, peregrine falcon, otter, black bear, raccoon, and deer, wetlands provide important food, water, or shelter. Many of the U.S. breeding bird populations-- including ducks, geese, woodpeckers, hawks, wading birds, and many song-birds-- feed, nest, and raise their young in wetlands. Migratory waterfowl use coastal and inland wetlands as resting, feeding, breeding, or nesting grounds for at least part of the year.

Isolated wetlands are among the most significant resources in terms of biological diversity. A study found that isolated wetlands supported 274 at-risk plant and animal species, 86 of which were covered by the U.S. Endangered Species Act. One South Carolina study estimated that 20 species of amphibians would become extinct if all of the state's isolated wetlands were lost.

One type of ephemeral wetland found in both California and the Northeast is known as a vernal pool because it generally fills with water in the spring. In California, blooming flowers ring the edges and fill depressions of such pools. Of the 450 species, subspecies, or varieties of plants found in California's vernal pools, 44 are vernal pool specialists. Several such plants are already on the Endangered Species list. If California's vernal pool habitats were completely destroyed, at least 44 species would disappear.

In the Upper Midwest, more than 1,169 species of plants have been identified in fens, with more than half needing wet conditions. Fens also have a high proportion of plant species known to occur primarily in pristine sites. Often, such species are listed as rare, threatened or endangered. Of 320 vascular plant species found within fens in northeastern Iowa, 44 percent are considered rare.

CONTRIBUTE TO ECONOMY

A wealth of natural products come from wetlands, including fish and shellfish, blueberries, cranberries, timber, and wild rice, as well as medicines from wetland soils and plants. Many of the nation's fishing and shellfishing industries harvest wetland-dependent species. In the Southeast, for example, nearly all the commercial catch and over half of the recreational

harvest are fish and shellfish that depend on the estuary-coastal wetland system. Louisiana's coastal marshes are tremendously valuable for their commercial fish and shellfish harvest.

Protecting headwaters and wetlands is important for the economy.

- Fishing: About 40 million anglers spend $45 billion annually to fish all kinds of waters, and the commercial salmon fishery alone is valued at $370 million annually.
- Manufacturing: Manufacturing companies use more than nine trillion gallons of fresh water every year; the beverage industry uses more than 12 billion gallons of water annually to produce products valued at $58 billion.
- Hunting: About 2.3 million people per year hunt migratory birds, which depend on healthy wetlands, spending more than $1.3 billion dollars per year in the process.
- Flooding: Each year, flooding causes an average of $1.9 billion in property damage and $438 million in damage to crops. Functioning wetlands can help to buffer communities from some of the worst impacts of severe floods.
- Agriculture: Farmers depend on clean water to irrigate farm crops across the country. In fact, irrigation accounts for 31 percent of all surface freshwater withdrawals in the U.S.

HEADWATERS AND WETLANDS ARE VULERNABLE

Many headwater streams have been lost or altered due to human activities. With each mile of headwater stream and acre of wetland destroyed, we are losing critical resources that feed the rivers, lakes and bays we depend on. It is estimated that more than half of the original wetland areas in the lower 48 states have been lost to development.

Headwater streams and isolated wetlands are extremely vulnerable to the direct and indirect impacts of land development for several reasons:

- They are significantly and rapidly affected by land alterations in their watersheds. In comparison, larger waterbodies areas can take months or even years to show the effects of land alterations that occur far upstream.
- They are relatively easy to fill or relocate compared to larger waterbodies because of their small size and, in some cases, occasional dryness.
- They are often unnamed, rarely appear on maps, and are not always wet. Therefore, they are not always recognized and protected.
- Headwater streams make up a significant majority of stream miles nationally, so the likelihood of disturbing one with human activities is high.